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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : D21H 23/02 — A1

(11) International Publication Number: WO 95/18886

(43) International Publication Date: 13 July 1995 (13.07.95)

(21) International Application Number: PCT/DK95/00011

(22) International Filing Date: 6 January 1995 (06.01.95)

(30) Priority Data:
0027/94 7 January 1994 (07.01.94) DK

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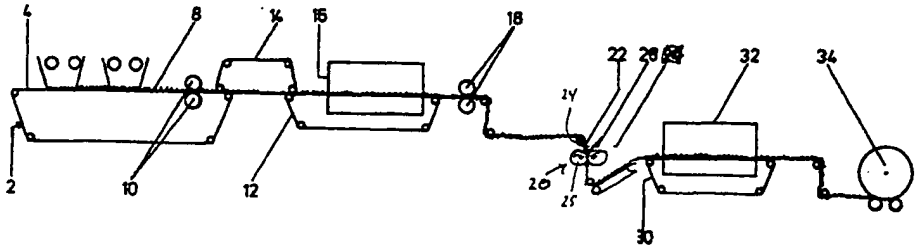
(81) Designated States: AM, AT, AT (Utility model), AU, BB, BG, BR, BY, CA, CH, CN, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, ES, FI, FI (Utility model), GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, SK (Utility model), TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ).

Published
With international search report.
In English translation (filed in Danish).

(54) Title: METHOD AND SYSTEM FOR MANUFACTURING A DRY-FORMED FIBROUS WEB



(57) Abstract

For the manufacturing of dry-formed webs of cellulose fibres there are two different ways of binding the fibres, viz. an application of glue to the web surfaces and, respectively, an admixing into the fibre charge of heat actuated binding fibres that are actuated by passing the web through a heating zone. The latter method is the better in practice, of course, in particular for liquid absorbing products, but the problem exists that the finished material is dusting with short, unbonded fibres. According to the invention it has been realized that it is possible to widely avoid this problem by auxiliary use of the first method, modified to the effect that both surfaces of the web are concurrently subjected to a supply of a very small amount of glue in foamed condition, e.g. with only 1 gram per square meter, whereby the surfaces remain permeable, but also sealing against extrusion of short fibres from inside the web.

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Method and system for manufacturing a dryformed fibrous web.

The present invention relates to a method for manufacturing a dryformed fibrous web material based on dryformed cellulose fibres with a suitable bonding. The laying out of the fibres for forming a current web is usually effected by a pulp material being defibrated and admixed into an airflow, which brings the loose fibres to a distributor head above a moving, perforated forming wire, underneath which is placed a suction chamber for down suction of the fibres against the wire, where they are currently deposited as a coherent fibrous pulp web with a desired web thickness. The products are typically used as liquid absorbing sheets.

It is important that the dryformed pulp web is stabilized or bonded, and in practice this is achieved in two different ways, viz. by application of glue or by use of binding fibres:

1. Gluing: On a carrier wire the pulp web is passed through a glueing station, in which, by means of a number of nozzles, a suitable glue, normally of the latex-type, is sprayed on the web, whereafter the wire is lead through a tunnel oven for drying out of the glue. Thereafter the web is transferred to an overhead wire, against which it is fixed by suction from above, so that the underside of the web is exposed, and the web is then lead through or over another glueing station, where glue is correspondingly sprayed against this underside of the web. Thereafter the web is lead through yet a tunnel oven for drying out and final setting of the glue, whereafter the web is self-supporting and can be wound up for storage or delivery.

By this method sheet webs of rather high quality is manufacturable, but as to machinery, the method is exacting and vulnerable to irregularities in the glueing

stations. It is furthermore a limitation that the method is not suitable for thick sheet webs, as it is difficult to achieve a high penetration depth of the glue, whereby a relatively thick layer tends to segregate in the centre plane, where the bonding is weak or completely lacks. The products will typically contain about 85% cellulose fibres and about 15% binding agent. Typical weights of products can be 50-120 g/m^2, as heavier products easily delaminate. Furthermore the products are bad suited for containing superabsorbers.

2. Use of binding fibres: By this method a homogeneous admixture of heat actuated binding fibres, also named thermobonding fibres, into the cellulose fibres is produced, whereby the dryformed web material may be fixed solely by being lead through a heating zone. As to system and control, this is a more simple method, by which also thick webs are manufacturable, as the bonding fibres will be evenly present in the outer as well as the inner planes of the material. The weight of product may typically be of 40-800 g/m^2, and a considerable admixing of superabsorbing agents or other additives is usable. The quality achievable is fully acceptable for many different applications, however, certain disadvantages occur in that already for economical reasons the admixing percentage of thermobonding fibres has to be limited typically to about 15 percent. Normally the cellulose fibres range in lengths between 0,5 and approximately 5 mm, whereas heat thermobonding fibres are often 6 mm or longer. In practice this gives a very good bonding of the longest cellulose fibres, whereas the very short cellulose fibres are bonded incompletely. This means that the material can dust with short fibres, which is generally a profound disadvantage, and the products are therefore used mainly as insert materials in outer wrappings. Thus the dust nuisances may be eliminated outwardly, but in return they

occur large-scale inside the plants, where the products are handled as insert material. Here there must be used powerful exhausting systems, which themselves create problems, and to this must be added that the associated aspiration of the 'dust' implies a removal of a noticeable part of the original material, whereby this part is added completely in vain and thus represents an actual waste.

By the invention it is desired to counter the said fibre dusting, which naturally brings about speculations in a higher percentage of admixture of binder fibres with different lengths. However, this is hardly any realistic possibility, and by the invention it is realized that a better solution will be a combined use of the two said methods, however with the glue method in a modified form.

As mentioned, by the glueing method a bonding result is achieved, which will be best at the web surface and poorer at the centre layer of the web, but if, by a combined application of the thermobonding binding fibres it is only a question of sealing against dusting from the web, this will be achievable by coating the web with very thin surface layers of glue. As the coherence in the web material will be secured by the activating of the thermobonding bonding fibres, a surface glue will be applicable simultaneously on both sides of the already selfsupporting web, and both of the applied glue layers, which, both of them, can be extremely thin, will be hardenable by passing through a single additional heating zone with relatively low capacity. When the surfaces of the web material thus appear with thin glue bondings, a sealing against extrusion of the short cellulose fibres from the web material is effected, and this is exactly the result desired. This implying that by the invention there will be no speculations in any increased local bonding of

said fibres, though the effect may partly depend on the very occurance f increased fibre bindings in the surface, whereas it is to a less degree a question of a actual coating of the surface.

It is thus a main feature of the invention that in the fibre bonding use is made of the admixed thermobonding fibres, whereas the web surfaces are sealed in more or less degree by adding glue in modest amounts, without ambition of any deep penetration of the glue into the material. It is then not decisive how the glue is applied, but to the invention, however, it is an important sub aspect to indicate how the glue can be applied in a new and very economical way for achieving the desired result.

Thus, according to the invention it is a preferred possibility that the glue is applied in a foamed condition, whereby it may cover the surfaces with a minimum of dry matter therein. The effect has been observed that the liquid in the setteling foam preferably settles in the intercrossing areas between the fibres rather than by a general settlement on the surfaces of the fibres, and this effect is optimum for the desired result, viz. that by use of small amounts of both liquid and dry matter a bonding of the short fibres in the surface be made, so that these partly remain in place and partly assist in sealing against extrusion of the short and unbonded fibres from the inside of the web material. This remains light and porous, so that for instance it will be suited for impregnated moisture tissues.

A good effect is achievable by admixing only 1-2 g of binder per m^2 per side, using a waterdispersed foamed binder with only approximately 2 g dry pulp pr. liter foam. The foam may be generated in a conventional foaming unit, and in the foamed volumen the glue may then be present in an amount of only some 0,2 volum n

percent. Correspondingly, there will be very little water to be dried out from the product, whereby the drying and the hardening of the glue may be effected with a rather low energy consumption in the aftercoupled hardening zone.

The application of the foam may be effected in any suitable way, for instance by vertical, sloping or horizontal feed of the web through mating rollers, with controlled foam supply to the roller gap on both sides of the web. A rolling process of the web gives an attractive result in that the surface fibres will be bonded in couched positions, whereby the surface gets a more smooth and firm character.

By means of admixed moisturing agents it is possible to control the penetration depth of the prefoamed binder. If the penetration depth is too little, the thin bonding layer in the surface will soon be abraised, and if the depth is too large, this will partly imply an unnecessary large consumption of binder and partly give the product a plastics-like character, with sluggish water absorption.

As mentioned above, the glue can dry out and be hardened at a low energy consumption, but it can, however, take place at such a high temperature that the bonding fibres can be reactivated, and as explained further below, this can give the most extraordinary result that the tensile strength of the web can be increased to nearly the double.

The invention gives significant results as regards planning of manufacturing of products with desired qualifications, without said qualifications being altered by a successive extrusion of the short fibres from the products. As this fibre amount may be of a noticeable size, the associated result will be that it is possible to dispose in a far better way for achieving the desired qualifications of the finished product.

The invention is in a preferred embodiment shown schematically in the drawing.

In the drawing a forming wire 2 is shown having a conveying stretch 4 below a pair of distributor heads 6 for supplying a mixture of loose cellulose fibres and heat thermobonding fibres to the stretch 4, on which is thus formed a loose web 8. The latter is compressed between rollers 10 and then transferred to a transport wire 12 via an overhead transfer station 14. The wire 12 brings the web through a heating zone 16, in which the thermobonding fibres are activated for bonding of the cellulose fibres, normally at a temperature of 130-140 °C. Thereafter, the now stabilised and self-supporting web is taken through mating rollers 18. Conventionally the web, now as a product web, is hereafter taken to upwinding in rolls 34 of finished products.

By the invention, however, a station 20 is after-coupled, in which the web 22, at both sides, is provided with a binder foam, preferably by the web being led down around a diversion roller 24 down to a so-called foulard-unit consisting of a pair of rollers 26 placed with adjustable spacing and with non-illustrated, upper means for adding impregnating compound 28 to the upper roller gap at both sides of the lead down web 22.

It is thus possible to control the supply of impregnating compound partly by adjusting the mating gap and partly by regulating the flow of the compound to a higher or lower level above the roller gab, for instance within a regulating range of 2-20 cm. Besides, the supply may in this case be adjusted by the contents of dry matter in the bonding agent (as an example within 5-15%) and by adjusting the foam density, for instance within the interval 20-100 g/l.

The hardness/softness of the product may be controlled by choise of a binder agent with a hard or soft film, respectively, whereas the hydrophile/hydrophobe

qualities of the product may be controlled by means of suitable prefoaming agents or additives.

Having passed the unit 20 the web 22 is taken onto a belt 30 through a heating tunnel 32, in which the web, preferably by means of added hot air, is heated to a quick evaporation of the aquaous part of the foam 28, whereafter the web is reeled up in the usual delivery roll 34.

Surprisingly, it has proved that by use of a suitable high temperature in the tunnel oven 32, preferably 130-140 °C, there is achieved not only an efficient water evaporation, but furthermore an improvement of the tensile strength of the web product of a whole 25-100%. This can not be explained from the very modest supply of glue at the outer sides of the web 22, but from other circumstances, however:

When the web 8 passes the rollers 10 it is pressed down against the carrier wire 2, which is normally a woven grid wire made of intersecting threads, which, by way of the associated intersections will form local, upwardly protruding and depressed parts, respectively. At the protruding parts the fibres in the web will be extra compressed when passing the rollers 10, so that the fibres as hereby locally depressed will be extra sensitive to the welding-effect occurring in the heating zone 16. However, this condition is weakened in that the web, while passing the transfer unit 14 is loosened somewhat, influenced by the weak tractive force and web movement, which is necessary for taking off the web from the forming wire and transferring it to the transfer wire, just as a corresponding loosening will occur at the transfer from the transfer wire to the oven wire. Besides, the compressed web has a certain expansion power, and thus the originally well depressed fibres will not be all to well depressed when passing the

hardening tunnel 16.

However, when the web 22 thereafter passes the station 20, a new compression of the web and a certain increase of the coherence in the surface layers of the web will occur, so that during the following passage through the oven unit 32 not only the said evaporation of the water from the foamed glue, but also a renewed heat activating of the thermobonding fibres will be provoked, as preferably there is operated with approximately the same temperature as in the tunnel 16, for instance approximately 140 C°.

Thus the glue treatment of the web will be some kind of catalyzer for the achievement of a following significantly increased tensile strength of the web material.

The immediate result of the invention, viz. the bonding or the sealing of the 'dust fibres' under maintenance of a non-sealed surface is advantageous also in another way, as a retained amount of said fibres just within the fixed surface layers has a significant fluid spreading effect, which is of great importance in absorbing products. In many of these products it is almost known beforehand that the liquid supply during use will only appear at a sub area of the product, and for a desired absorbing capacity a superabsorbent has to be dosed in consideration of this. If the product can appear with a good distribution ability, the dosing of the superabsorbent can be minimized.

There is reason to stress that the aqueous foam can be added on both sides of a product having a centre layer of a superabsorbent material without said material having to become activated with water. For example, the product may have a fibre bottom layer of 70 g/m^2, an intermediate layer of superabsorbent of 30 g/m^2 and a fibre top layer of 30 g/m^2.

The invention is advantageous also as far as filter

materials ar concerned, where both the significantly reduced dusting and the sustained content of short fibres is of a positive effect.

It is by the invention possible to use the bonding foam as carrier for colouring pigments, these being added before the foaming, whereby a certain dyeing of the products can be produced in a most simple way. However, as the binder is normally used in very modest amounts, only dyeing in pastel colours is achievable, unless the process is specifically adapted with respect to a more powerful dyeing.

By the invention it has proved possible to foam-coate a thermally bonded air laid product which only contains some few percents of binding fibres, for instance 5%, by application of an increased amount of glue binder, for instance 10%, whereby it is possible to manufacture a predominantly 'latex-bonded' product without the binder having to be added by the traditional spraying technique. Hereby the same abraisive resistant surface is achieved as by traditional binder spraying, but without the associated limitation of the maximum thickness of the web, which usually lies at 100/120 g/m^2. At such thicknesses it has been necessary to impregnate the web in order to avoid delamination of the product, but this is not necessary in the present situation, and this means, inter alia, that products with rather low density can be manufactured. According to the invention, in working with a significantly reduced amount of glue, thick products will hold a noticeably increased amount of cellulose fibres not covered by a film of binding agent and thus having optimum absorption abilities.

From a process point of view it is advantageous that the application of the binding agent is effected at only one place in the system and not at two places as in the prior art. Moreover, it is most advantageous to

avoid the traditional spraying stations, which give rise t many problems with respect to both peration and maintenance, while e.g. a foulard provides for a good and even treating result and is easy to maintain. However, other foam application techniques could be used, e.g. the so-called screen coating.

In principle, nothing prevents the binder foam from being applied to the web already before the same is thermally fixed, and in that case it may be sufficient to use a single succeeding heating zone for the actuation of both the binding fibres and the glue agent.

Finally a couple of examples of manufacture of specific products according to the invention should be given:

A. Production of a foam coated, hydrophile product.

An air laid product, 60 g/m^2, consisting of 85% wooden cellulose fibres with largest possible content of long fibres and 15% thermobonding fibres, is foam coated in a foulard, the roller gap of which is adjusted to 0,6 mm. The prefoamed binding agent is produced in the following way:

Binder mix specification:

11.1% Sarpifan WRG	(Stockhausen, DE)
0.2% Rohagal 10 n	(Röhm GmbH, DE)
88.7% Water	

The binding agent is foamed to a density of 20 g/l.

If the foam level in the foulard is about 4 cm, approximately 1,5 g binder (100% drystuff) each m^2 at each side of the product is added.

After the foam coating, the product is dryed in a normal way, for instance at 140 C°.

B. Manufacturing of a foam coated, hydrophobe product.

The product is manufactured in the same way as mentioned above, but with a different binder mix specification:

Binder mix specification:

11.1% Sarpifan WRG	(Stockhausen, DE)
2.0% Stokal STA	(Stockhausen, DE)
86.9% Water	

C L A I M S:

1. Method for manufacturing a dryformed paper material by successive laying of a web of cellulose fibres on a forming wire and treating the web to provide bonding of the fibres therein, characterised in that the binding of the fibres is effected by a combination of an activating of thermobonding fibres supplied by previous admixing into the cellulose fibres and an application of binder to the surfaces of the web, this application being conducted with a dry matter part significantly below 18%, preferably 0.5-5%, in purpose of bonding of short cellulose fibres at the surfaces.

2. Method according to claim 1, characterized in the binder being applied in an amount of 0,5-10 g dry matter per square metre web surface.

3. Method according to claim 1, characterised in the binder being applied to the surfaces of the web after this is stabilised by thermal activating of the thermobonding fibres, and in the binder being hardened by running-through heating of the web at such a high temperature that the bonding fibres are reactivated.

4. Method according to claim 1, characterised in the binder being applied in foamed condition, i.e. with water/air as carrier.

5. Method according to claim 4, characterised in the web material, despite the application of the aqueous binder, is manufactured with one or more centre layers containing or consisting of superabsorbent material.

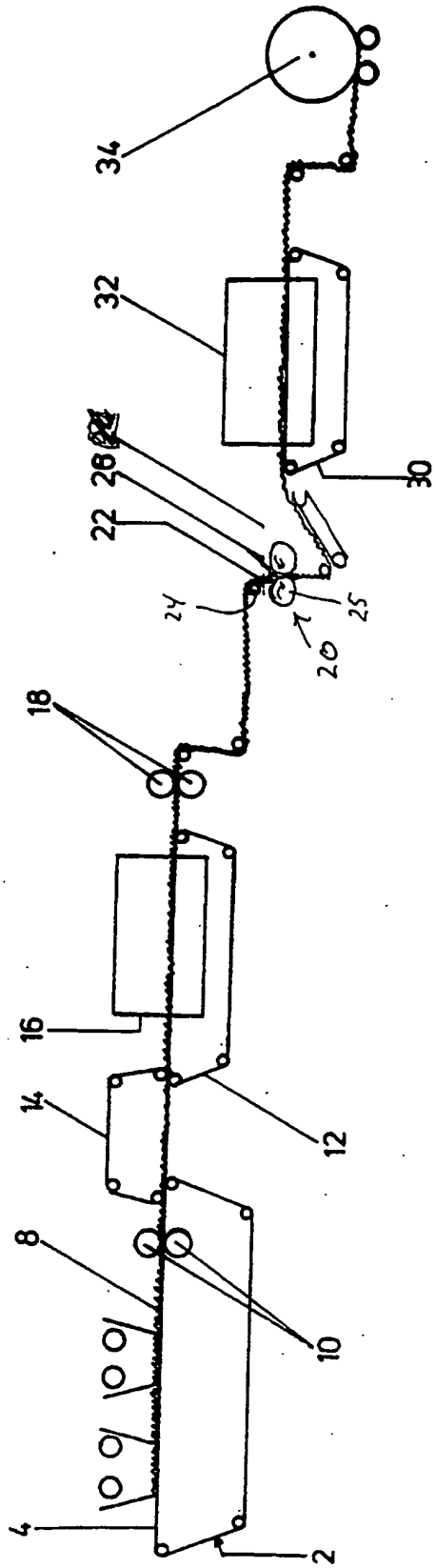
6. Method according to claim 1, characterized in the binder being used in admixture with pigments.

7. Method according to claim 1, characterized in that for manufacturing of a predominantly termally bonded material use is made of a web with 10-25% thermobonding fibres and a binder dosage of 0,5-10 g/m^2 surface is.

8. Method according to claim 1, characterized in that for manufacturing of a predominantly binder bonded material use is made of a web with 3-7% thermobonding fibres and a binder dosage of 5-20% g/m^2 surface.

9. System for carrying out the method according to claim 1, comprising a device for dry-laying of the fibres on a forming wire for forming of a fibrous web and a device for actuation of means for bonding of the fibres, characterized by the combination of the laying-out device being of the the type which operates based on fibres with admixed thermobonding fibres, whereby the actuation device is a heating zone, and of the presence of a station for application of relatively small amounts of binder to the surfaces of the web, viz. sufficiently to make the finished web material mainly non-dusting.

10. System according to claim 9, characterized in the binder station comprising means such as a foulard for application of the binder in a carrier of foam.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INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 95/00011

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21H 23/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CLAIMS, JAPIO, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP, A1, 0202472 (GRAIN PROCESSING CORPORATION), 26 November 1986 (26.11.86), page 9, line 18 - page 12, line 12, figure 1, claims 1,4-5 --	1-10
A	US, A, 4292271 (JAMES F. BUOB ET AL), 29 Sept 1981 (29.09.81), column 3, line 39 - column 5, line 64, figure 1, claim 1 --	1-10
A	US, A, 4385954 (WALTER L. PAULS ET AL), 31 May 1983 (31.05.83), column 3, line 22 - column 5, line 29, figure 1, abstract --	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
7 April 1995	27 -04- 1995
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Barbro Nilsson Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

25/02/95

International application No.
PCT/DK 95/00011

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A1- 0202472	26/11/86	SE-T3- 0202472	
US-A- 4292271	29/09/81	NONE	
US-A- 4385954	31/05/83	US-A- 4348251	07/09/82